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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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Connolly Bove Lodge & Hutz LLP Suite 800 1990 M Street, N.W. Washington, DC 20036-3425			EXAMINER GRAYBILL, DAVID E	
			ART UNIT 2822	PAPER NUMBER

DATE MAILED: 12/08/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

09/985,693

Applicant(s)

FERENCE ET AL.

Examiner

David E Graybill

Art Unit

2822

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 23 September 2004.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 26,28,30-32,35-45,50,52-54,56 and 57 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 26,28,30-32,35-45,50,52-54,56 and 57 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |  |   |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                                   | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

In the rejections infra, generally, reference labels are recited only for the first recitation of identical claim elements.

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 26, 28, 30-32, 35-37, 39-45, 50, 52-54, 56 and 57 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Nishiguchi (5214308) and Kashiba (JP06112463).

At column 4, line 41 to column 6, line 52, Nishiguchi discloses a method of fabricating a semiconductor structure, the method comprising:

providing a first substrate 3 and a second substrate 1; providing a plurality of controlled collapse chip connection ("C4") solder bump contacts 2b on one of the first substrate and the second substrate; providing first solder bumps 2a on one of the first substrate and the second substrate; mounting the first substrate on the second substrate; wherein the plurality of C4 solder bump contacts have a different solder composition than the first solder bumps; and reflowing the first solder bumps at a first temperature to initially align the plurality of C4 contacts by a surface tension of the reflowed first solder bumps; and finely aligning the plurality of C4 contacts by reflowing the plurality of C4 contacts at a second temperature higher than the first temperature; wherein at least one of the first substrate and the second substrate is an integrated circuit chip; wherein the C4 solder bump contacts ball up to make contact between the first substrate and the second substrate; wherein the C4 solder bump contacts are smaller than the first solder bumps; wherein reflowing the first solder bumps draws the first substrate toward the second substrate to cause the contacts to make contact with the first substrate and the second substrate; wherein the first solder bumps contact the first substrate and the second substrate prior to the plurality of C4 contacts making contact between the first substrate and the second substrate; wherein the plurality of C4 contacts are provided with a smaller diameter than the first solder bumps; wherein the plurality of C4

contacts and the first solder bumps are provided such that an upper surface of the plurality of C4 contacts and an upper surface of the first solder bumps are co-planar; providing a ledge (narrow flat surface 5a) on at least one of the first substrate and the second substrate, wherein the first solder bumps are arranged in contact with the ledge, such that an upper surface of the plurality of C4 plurality of C4 contacts and an upper surface of the first solder bumps are co-planar; wherein the plurality of C4 contacts are inherently (due to one or more of collapse of the first solder bumps; the weight of the second substrate, contacts and bumps; surface tension; and "lightly pushing") compressed as the first solder bumps are reflowed; further comprising arranging the first solder bumps around a periphery of an area containing the plurality of C4 contacts; further comprising ensuring that the first solder bumps are free of an electrical connection with any of the plurality of C4 contacts; wherein the step of providing plurality of C4 contacts on one of the first substrate and the second substrate comprises providing a plurality of C4 solder bump plurality of C4 contacts each having a volume smaller than a volume of each of the plurality of first solder bumps.

To further clarify, it is noted that, as cited, Nishiguchi discloses controlled collapse chip connection ("C4") solder bump contacts as they are described by applicant in the specification at page 2, lines 1-16; namely, "a

plurality of balls or bumps of solder between two structures having self-aligning capabilities to ensure proper alignment of the two structures joined. The self-aligning capabilities result from surface tension inherent in the solder in the C4 connections. The solder adheres to connecting elements, such as pads, on the two structures being joined, and the surface tension draws the two structures together and aligns the connecting elements the solder attaches to." Indeed, in the remarks filed on 9-23-4, at page 10, penultimate line, applicant explicitly admits that Nishiguchi discloses controlled collapse chip connection ("C4") solder bump contacts.

However, Nishiguchi does not appear to explicitly disclose wherein the plurality of C4 solder bump contacts have a different solder composition than the first solder bumps; a second temperature higher than the first temperature; wherein the C4 solder bump contacts comprise a material having a higher melting point than the first solder bumps, and reflowing the C4 solder bump contacts requires heating the C4 solder bump contacts to a higher temperature than reflowing the first solder bumps; wherein the plurality of C4 contacts are provided by thin film processing; wherein the plurality of C4 contacts each are provided with a diameter of less than about 50  $\mu\text{m}$ ; wherein the contacts are provided with a pitch of less than about 100  $\mu\text{m}$ ; wherein the contacts are compressed as the first solder bumps are reflowed.

Nonetheless, in the English translation at paragraph 16, abstracts and figures, Kashiba discloses wherein the plurality of C4 solder bump contacts 6a have a different solder composition than the first solder bumps 5a; a second temperature higher than the first temperature; wherein the C4 solder bump contacts comprise a material having a higher melting point than the first solder bumps, and reflowing the C4 solder bump contacts requires heating the C4 solder bump contacts to a higher temperature than reflowing the first solder bumps; wherein the plurality of C4 contacts are provided by thin film processing "vacuum evaporation"; wherein the plurality of C4 contacts each are provided with a diameter of less than about 50  $\mu\text{m}$ ; wherein the contacts are provided with a pitch of less than about 100  $\mu\text{m}$ ; wherein the contacts are compressed as the first solder bumps are reflowed. Moreover, it would have been obvious to combine this process of Kashiba with the process of Nishiguchi because it would facilitate alignment.

In any case, as cited *supra*, Nishiguchi discloses that both contact diameter and pitch are result-effective variables. Moreover, it would have been an obvious matter of design choice bounded by well known manufacturing constraints and ascertainable by routine experimentation and optimization to choose the particular claimed dimensions because applicant has not disclosed that, in view of the applied prior art, the dimensions are for a particular unobvious purpose, produce an unexpected result, or are

otherwise critical, and it appears prima facie that the process would possess utility using other dimensions. Indeed, it has been held that optimization of range limitations are prima facie obvious absent a disclosure that the limitations are for a particular unobvious purpose, produce an unexpected result, or are otherwise critical. See MPEP 2144.05(II): "Generally, differences in concentration or temperature will not support the patentability of subject matter encompassed by the prior art unless there is evidence indicating such concentration or temperature is critical. '[W]here the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation.'" In re Aller, 220 F.2d 454, 105 USPQ 233, 235 (CCPA 1955). See also In re Hoeschele, 406 F.2d 1403, 160 USPQ 809 (CCPA 1969), Merck & Co. Inc. v. Biocraft Laboratories Inc., 874 F.2d 804, 10 USPQ2d 1843 (Fed. Cir.), cert. denied, 493 U.S. 975 (1989), and In re Kulling, 897 F.2d 1147, 14 USPQ2d 1056 (Fed. Cir. 1990). As set forth in MPEP 2144.05(III), "Applicant can rebut a prima facie case of obviousness based on overlapping ranges by showing the criticality of the claimed range. 'The law is replete with cases in which the difference between the claimed invention and the prior art is some range or other variable within the claims. . . . In such a situation, the applicant must show that the particular range is critical, generally by showing that the claimed range achieves unexpected results relative to the



prior art range.’ In re Woodruff, 919 F.2d 1575, 16 USPQ2d 1934 (Fed. Cir. 1990). See MPEP § 716.02 - § 716.02(g) for a discussion of criticality and unexpected results.” Also, it has been held that mere dimensional limitations are prima facie obvious absent a disclosure that the limitations are for a particular unobvious purpose, produce an unexpected result, or are otherwise critical. See, for example, In re Rose, 220 F.2d 459, 105 USPQ 237 (CCPA 1955); In re Rinehart, 531 F.2d 1048, 189 USPQ 143 (CCPA 1976); Gardner v. TEC Systems, Inc., 725 F.2d 1338, 220 USPQ 777 (Fed. Cir. 1984), cert. denied, 469 U.S. 830, 225 USPQ 232 (1984); In re Dailey, 357 F.2d 669, 149 USPQ 47 (CCPA 1966).

Also, neither Nishiguchi nor Kashiba appear to explicitly disclose wherein the contacts each are provided with a diameter of about 10  $\mu\text{m}$ ; wherein the contacts each are provided with a diameter of less than about 10  $\mu\text{m}$ ; wherein the contacts are provided with a pitch of about 30  $\mu\text{m}$ ; wherein the contacts are provided with a diameter about 20% of the diameter of the first solder bumps.

Regardless, as cited supra, both Nishiguchi and Kashiba disclose that contact pitch and diameter are result-effective variables. Moreover, it would have been an obvious matter of design choice bounded by well known manufacturing constraints and ascertainable by routine experimentation and optimization to choose the particular claimed dimensions because applicant

has not disclosed that, in view of the applied prior art, the dimensions are for a particular unobvious purpose, produce an unexpected result, or are otherwise critical, and it appears prima facie that the process would possess utility using other dimensions. Indeed, it has been held that optimization of range limitations are prima facie obvious absent a disclosure that the limitations are for a particular unobvious purpose, produce an unexpected result, or are otherwise critical. See MPEP 2144.05(II): "Generally, differences in concentration or temperature will not support the patentability of subject matter encompassed by the prior art unless there is evidence indicating such concentration or temperature is critical. '[W]here the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation.'" In re Aller, 220 F.2d 454, 105 USPQ 233, 235 (CCPA 1955). See also In re Hoeschele, 406 F.2d 1403, 160 USPQ 809 (CCPA 1969), Merck & Co. Inc. v. Biocraft Laboratories Inc., 874 F.2d 804, 10 USPQ2d 1843 (Fed. Cir.), cert. denied, 493 U.S. 975 (1989), and In re Kulling, 897 F.2d 1147, 14 USPQ2d 1056 (Fed. Cir. 1990). As set forth in MPEP 2144.05(III), "Applicant can rebut a prima facie case of obviousness based on overlapping ranges by showing the criticality of the claimed range. 'The law is replete with cases in which the difference between the claimed invention and the prior art is some range or other variable within the claims. . . . In such a situation, the

applicant must show that the particular range is critical, generally by showing that the claimed range achieves unexpected results relative to the prior art range.’ In re Woodruff, 919 F.2d 1575, 16 USPQ2d 1934 (Fed. Cir. 1990). See MPEP § 716.02 - § 716.02(g) for a discussion of criticality and unexpected results.” Also, it has been held that mere dimensional limitations are prima facie obvious absent a disclosure that the limitations are for a particular unobvious purpose, produce an unexpected result, or are otherwise critical. See, for example, In re Rose, 220 F.2d 459, 105 USPQ 237 (CCPA 1955); In re Rinehart, 531 F.2d 1048, 189 USPQ 143 (CCPA 1976); Gardner v. TEC Systems, Inc., 725 F.2d 1338, 220 USPQ 777 (Fed. Cir. 1984), cert. denied, 469 U.S. 830, 225 USPQ 232 (1984); In re Dailey, 357 F.2d 669, 149 USPQ 47 (CCPA 1966).

Claim 38 is rejected under 35 U.S.C. 103(a) as being unpatentable over Nishiguchi and Kashiba as applied to claim 37, and further in combination with Love.

Nishiguchi and Kashiba do not appear to explicitly disclose wherein the thin film processing comprises lift off stencil or subtractive etch. Still, as cited supra, the combination of Nishiguchi and Kashiba discloses wherein the thin film processing comprises evaporation. In addition, at column 3, lines 57-62, Love discloses that evaporation and lift off stencil are alternatives and equivalents; therefore, it would have been obvious to substitute or

combine the lift off stencil of Love for or with the evaporation of Nishiguchi and Kashiba. See *In re May* (CCPA) 136 USPQ 208 (It is our opinion that the substitution of Wille's type seal for the cement of Hallauer in Figure 1 would be obvious to persons of ordinary skill in the art from the disclosures of these references, merely involving an obvious selection between known alternatives in the art and the application of routine technical skills.); *In re Cornish* (CCPA) 125 USPQ 413; *In re Soucy* (CCPA) 153 USPQ 816; *Sabel et al. v. The Wickes Corporation et al.* (DC SC) 175 USPQ 3; *Ex parte Seiko Koko Kabushiki Kaisha Co.* (BdPatApp&Int) 225 USPQ 1260; and *Ex parte Rachlin* (BdPatApp&Int) 151 USPQ 56. See also *Smith v. Hayashi*, 209 USPQ 754 (Bd. of Pat. Inter. 1980) (However, there was evidence that both phthalocyanine and selenium were known photoconductors in the art of electrophotography. "This, in our view, presents strong evidence of obviousness in substituting one for the other in an electrophotographic environment as a photoconductor." 209 USPQ at 759.). An express suggestion to substitute one equivalent component or process for another is not necessary to render such substitution obvious. *In re Fout*, 675 F.2d 297, 213 USPQ 532 (CCPA 1982). "It is prima facie obvious to combine two compositions each of which is taught by the prior art to be useful for the same purpose, in order to form a third composition to be used for the very same purpose.... [T]he idea of combining them flows logically from their

having been individually taught in the prior art." In re Kerkhoven, 626 F.2d 846, 850, 205 USPQ 1069, 1072 (CCPA 1980) (citations omitted). See also In re Crockett, 279 F.2d 274, 126 USPQ 186 (CCPA 1960); Ex parte Quadranti, 25 USPQ2d 1071 (Bd. Pat. App. & Inter. 1992).

Claims 26, 28, 30-32, 35-37, 39, 42, 45 and 50, 52-54, 56 and 57 are rejected under 35 U.S.C. 102(b) as being anticipated by Kashiba (JP06112463).

As cited supra, Kashiba discloses a method of fabricating a semiconductor structure, the method comprising: providing a first substrate 1 and a second substrate 2; providing a plurality of controlled collapse chip connection ("C4") [sic] solder bump contacts 6a on one of the first substrate and the second substrate; providing first solder bumps 5a on one of the first substrate and the second substrate; wherein the plurality of C4 solder bump contacts have a different solder composition than the first solder bumps; mounting the first substrate on the second substrate; and reflowing the first solder bumps at a first temperature to initially align the plurality of C4 contacts by a surface tension of the reflowed first solder bumps; and finely aligning the plurality of C4 contacts by reflowing the plurality of C4 contacts at a second temperature higher than the first temperature; wherein at least one of the first substrate and the second substrate is an integrated circuit chip; wherein the C4 solder bump contacts ball up to make contact between

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the first substrate and the second substrate; wherein the C4 solder bump contacts comprise a material having a higher melting point than the first solder bumps, and reflowing the C4 solder bump contacts requires heating the C4 solder bump contacts to a higher temperature than reflowing the first solder bumps; wherein the C4 solder bump contacts are smaller than the first solder bumps; wherein reflowing the first solder bumps draws the first substrate toward the second substrate to cause the plurality of C4 contacts to make contact with the first substrate and the second substrate; wherein the first solder bumps contact the first substrate and the second substrate prior to the plurality of C4 contacts making contact between the first substrate and the second substrate; wherein the plurality of C4 contacts are provided by thin film processing; wherein the plurality of C4 contacts each are provided with a diameter of less than about 50  $\mu\text{m}$ ; wherein the plurality of C4 contacts are provided with a pitch of less than about 100  $\mu\text{m}$ ; wherein the plurality of C4 contacts are provided with a smaller diameter than the first solder bumps; wherein the contacts and the first solder bumps are provided such that an upper surface of the plurality of C4 contacts and an upper surface of the first solder bumps are co-planar; providing a ledge (narrow flat surface) on at least one of the first substrate and the second substrate, wherein the first solder bumps are arranged in contact with the ledge, such that an upper surface of the plurality of C4 contacts and an

upper surface of the first solder bumps are co-planar; wherein the plurality of C4 contacts are compressed as the first solder bumps are reflowed; further comprising arranging the first solder bumps around a periphery of an area containing the plurality of C4 contacts; further comprising ensuring that the first solder bumps are free of an electrical connection with any of the plurality of C4 contacts; wherein the step of providing plurality of C4 contacts on one of the first substrate and the second substrate comprises providing a plurality of C4 solder bump plurality of C4 contacts each having a volume smaller than a volume of each of the plurality of first solder bumps.

To further clarify, it is noted that, as cited, Kashiba discloses controlled collapse chip connection ("C4") solder bump contacts as they are described by applicant in the specification at page 2, lines 1-16; namely, "a plurality of balls or bumps of solder between two structures having self-aligning capabilities to ensure proper alignment of the two structures joined. The self-aligning capabilities result from surface tension inherent in the solder in the C4 connections. The solder adheres to connecting elements, such as pads, on the two structures being joined, and the surface tension draws the two structures together and aligns the connecting elements the solder attaches to."

Claim 38 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kashiba as applied alone to claim 37 *supra*, and further in combination with Love.

Kashiba does not appear to explicitly disclose wherein the thin film processing comprises lift off stencil or subtractive etch.

Nonetheless, as cited *supra*, Kashiba discloses wherein the thin film processing comprises evaporation. In addition, as cited, Love discloses that evaporation and lift off stencil are alternatives and equivalents; therefore, it would have been obvious to substitute or combine the lift off stencil of Love for or with the evaporation of Kashiba. See *In re May* (CCPA) 136 USPQ 208 (It is our opinion that the substitution of Wille's type seal for the cement of Hallauer in Figure 1 would be obvious to persons of ordinary skill in the art from the disclosures of these references, merely involving an obvious selection between known alternatives in the art and the application of routine technical skills.); *In re Cornish* (CCPA) 125 USPQ 413; *In re Soucy* (CCPA) 153 USPQ 816; *Sabel et al. v. The Wickes Corporation et al.* (DC SC) 175 USPQ 3; *Ex parte Seiko Koko Kabushiki Kaisha Co.* (BdPatApp&Int) 225 USPQ 1260; and *Ex parte Rachlin* (BdPatApp&Int) 151 USPQ 56. See also *Smith v. Hayashi*, 209 USPQ 754 (Bd. of Pat. Inter. 1980) (However, there was evidence that both phthalocyanine and selenium were known photoconductors in the art of electrophotography. "This, in our view,



presents strong evidence of obviousness in substituting one for the other in an electrophotographic environment as a photoconductor." 209 USPQ at 759.). An express suggestion to substitute one equivalent component or process for another is not necessary to render such substitution obvious. In re Fout, 675 F.2d 297, 213 USPQ 532 (CCPA 1982). "It is prima facie obvious to combine two compositions each of which is taught by the prior art to be useful for the same purpose, in order to form a third composition to be used for the very same purpose.... [T]he idea of combining them flows logically from their having been individually taught in the prior art." In re Kerkhoven, 626 F.2d 846, 850, 205 USPQ 1069, 1072 (CCPA 1980) (citations omitted). See also In re Crockett, 279 F.2d 274, 126 USPQ 186 (CCPA 1960); Ex parte Quadranti, 25 USPQ2d 1071 (Bd. Pat. App. & Inter. 1992).

Claims 40, 41, 43 and 44 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kashiba (JP06112463).

Kashiba is applied for the same reasons it was applied alone to claim 37 supra.

However, Kashiba does not appear to explicitly disclose wherein the plurality of C4 contacts each are provided with a diameter of about 10  $\mu\text{m}$ ; wherein the plurality of C4 contacts each are provided with a diameter of less than about 10  $\mu\text{m}$ ; wherein the plurality of C4 contacts are provided

with a pitch of about 30  $\mu\text{m}$ ; wherein the plurality of C4 contacts are provided with a diameter about 20% of the diameter of the first solder bumps.

Regardless, as cited *supra*, Kashiba discloses that contact pitch and diameter are result-effective variables. Moreover, it would have been an obvious matter of design choice bounded by well known manufacturing constraints and ascertainable by routine experimentation and optimization to choose the particular claimed dimensions because applicant has not disclosed that, in view of the applied prior art, the dimensions are for a particular unobvious purpose, produce an unexpected result, or are otherwise critical, and it appears *prima facie* that the process would possess utility using other dimensions. Indeed, it has been held that optimization of range limitations are *prima facie* obvious absent a disclosure that the limitations are for a particular unobvious purpose, produce an unexpected result, or are otherwise critical. See MPEP 2144.05(II): "Generally, differences in concentration or temperature will not support the patentability of subject matter encompassed by the prior art unless there is evidence indicating such concentration or temperature is critical. '[W]here the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation.'" In *re* Aller, 220 F.2d 454, 105 USPQ 233, 235 (CCPA 1955). See also In *re*

Hoeschele, 406 F.2d 1403, 160 USPQ 809 (CCPA 1969), Merck & Co. Inc. v. Biocraft Laboratories Inc., 874 F.2d 804, 10 USPQ2d 1843 (Fed. Cir.), cert. denied, 493 U.S. 975 (1989), and In re Kulling, 897 F.2d 1147, 14 USPQ2d 1056 (Fed. Cir. 1990). As set forth in MPEP 2144.05(III), "Applicant can rebut a prima facie case of obviousness based on overlapping ranges by showing the criticality of the claimed range. 'The law is replete with cases in which the difference between the claimed invention and the prior art is some range or other variable within the claims. . . . In such a situation, the applicant must show that the particular range is critical, generally by showing that the claimed range achieves unexpected results relative to the prior art range.' In re Woodruff, 919 F.2d 1575, 16 USPQ2d 1934 (Fed. Cir. 1990). See MPEP § 716.02 - § 716.02(g) for a discussion of criticality and unexpected results." Also, it has been held that mere dimensional limitations are prima facie obvious absent a disclosure that the limitations are for a particular unobvious purpose, produce an unexpected result, or are otherwise critical. See, for example, In re Rose, 220 F.2d 459, 105 USPQ 237 (CCPA 1955); In re Rinehart, 531 F.2d 1048, 189 USPQ 143 (CCPA 1976); Gardner v. TEC Systems, Inc., 725 F.2d 1338, 220 USPQ 777 (Fed. Cir. 1984), cert. denied, 469 U.S. 830, 225 USPQ 232 (1984); In re Dailey, 357 F.2d 669, 149 USPQ 47 (CCPA 1966).

Applicant's amendment and remarks filed 9-23-4 have been fully considered, are addressed by the rejections supra, and are further addressed infra.

Applicant alleges that, in the combination of Nishiguchi and Kashiba, "Kashiba does [sic] make up for the previously identified deficiencies of Nishiguchi, discussed above with respect to C4 contacts in independent claim 26, and does not teach or suggest that small bump size and smaller pitch achievable by use of C4 contacts, as variously claimed."

These allegations are respectfully deemed unpersuasive because Kashiba is not necessarily relied on in the rejection to make up for applicant's alleged deficiencies of Nishiguchi. Furthermore, as elucidated in the rejection, Kashiba discloses some of the claimed dimensions, and is not applied to the rejection for a disclosure of the remaining dimensions.

Also, applicant appears to argue that the combination of Nishiguchi and Kashiba does not disclose that that contact pitch and diameter are result-effective variables because, "the applied prior art does not recognize achievement of high integration density, i.e., small C4 contact pitch and bump size, as being a function of solder surface tension of first solder bumps use to initially align a plurality of C4 solder bump contacts."

This argument is respectfully deemed unpersuasive because the prior art is not necessarily applied to the rejection for a disclosure of recognition

of achievement of high integration density, i.e., small C4 contact pitch and bump size, as being a function of solder surface tension of first solder bumps use to initially align a plurality of C4 solder bump contacts. In any case, as elucidated in the rejection, the combination of Nishiguchi and Kashiba discloses that that contact pitch and diameter are result-effective variables.

Applicant also asserts that, "the assertion of 'obvious design choice' appears to ignore the discussion of particular C4 contact spacing, provided above as background discussion, and as set forth in the Specification."

This assertion is respectfully traversed because it is mere conjecture, and in fact, toward the end of compact prosecution, nothing relevant to examination of the claims has been ignored.

Applicant also quotes case law, "[t]he BPAI held that appellant had simply made an obvious design choice. However, the different structures of appellant and of the reference achieve different purposes. . . . A finding of 'obvious design choice' is precluded where claimed structure and the function it performs are different from those of the prior art."

These quotations are respectfully deemed unpersuasive because the rejection does not hold that appellant had simply made an obvious design choice. Rather, it is maintained in the rejection that in view of the applied prior art disclosures, it would have been an obvious matter of design choice bounded by well known manufacturing constraints and ascertainable by

routine experimentation and optimization to choose the particular claimed dimensions because applicant has not disclosed that, in view of the applied prior art, the dimensions are for a particular unobvious purpose, produce an unexpected result, or are otherwise critical, and it appears prima facie that the process would possess utility using other dimensions. Further, ample legal precedent is relied on to provide the rationale supporting obviousness. In addition, the quotation, "A finding of 'obvious design choice' is precluded where claimed structure and the function it performs are different from those of the prior art" is an inaccurate summary of *In re Gal*, 25 USPQ2d 1076 in *In re Chu*, 36USPQ2d 1089. Specifically, nowhere in *In re Gal* is this quotation found, nor is it otherwise supported. Therefore, applicant's reliance on this quotation as a per se rule is respectfully deemed unpersuasive.

Similarly applicant quotes case law, "[t]o require an applicant to include in his specification evidence and arguments regarding whether particular subject matter was a matter of 'design choice' would be tantamount to requiring the applicant to divine, before an application is filed, rejections the PTO will proffer."

This quotation is respectfully deemed unpersuasive because applicant has not been required to include in the specification evidence and arguments regarding whether particular subject matter was a matter of design choice.

In addition, the quotations supra are respectfully deemed unpersuasive because they are derived from case law wherein the facts in the cases are not sufficiently similar to those in the instant record. For example, the quoted case law is not directed to optimization of disclosed dimensions or result effective variables.

Relatedly, applicant argues, "a finding of 'obvious design choice' should also be precluded when the applied art does not acknowledge the nature of the particular problem solved by Applicants' disclosed and claimed invention, i.e., achieving higher chip contact integration densities and reduced contact size and pitch with reliable contact alignment."

This argument is respectfully deemed unpersuasive and traversed because the applied prior art acknowledges the nature of the problem allegedly solved by applicants disclosed and claimed invention, i.e., achieving higher chip contact integration densities and reduced contact size and pitch with reliable contact alignment. For example, at column 1, lines 21-26, Nishiguchi discloses, "Further, the higher the interaction density of the semiconductor device is, the smaller are the size and pitch of the electrode terminals formed on the substrate. As a result, as the integration density goes higher, it is necessary to more precisely position the bump to the electrode terminal." Similarly, at paragraphs 11 and 19, Kashiba discloses, "In the semiconductor device of this invention, the melting point

performs self-alignment by the first low bump with large size, easily, positioning connection is made and connection of high density is made to high degree of accuracy using the second bump with small size with the high melting point," and, "Here, it is a diameter as size of the first bump material 5a and 5A. About 40 micrometers is assumed as a distance between the diameter of 50 micrometers, and a bump as size of 100 micrometers and the second bump material 6a, 6A, 6b, and 6B. As shown in drawing 2 (a), supposing 30 micrometers of bump location gaps occur in a longitudinal direction at the cross direction of 60 micrometers and space, . . . . Consequently, self-alignment becomes possible as shown in drawing 2 (c). . . . thus, the face down assembly by the flip chip -- setting -- the densification of 50-micrometer pitch level -- dependability -- it can carry out highly." In any case, the reason or motivation to modify the reference may often suggest what the inventor has done, but for a different purpose or to solve a different problem. It is not necessary that the prior art suggest the combination to achieve the same advantage or result discovered by applicant. See MPEP 2144 and *In re Linter*, 458 F.2d 1013, 173 USPQ 560 (CCPA 1972); *In re Dillon*, 919 F.2d 688, 16 USPQ2d 1897 (Fed. Cir. 1990), cert. denied, 500 U.S. 904 (1991).

**THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).



A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

**For information on the status of this application applicant should check PAIR:**

Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

**Alternatively, applicant may contact the File Information Unit at (703) 308-2733. Telephone status inquiries should not be directed to the examiner. See MPEP 1730VIC, MPEP 203.08 and MPEP 102.**

Any other telephone inquiry concerning this communication or earlier communications from the examiner should be directed to David E. Graybill at (571) 272-1930. Regular office hours: Monday through Friday, 8:30 a.m. to 6:00 p.m.  
The fax phone number for group 2800 is (703) 872-9306.



David E. Graybill  
Primary Examiner  
Art Unit 2827

Application/Control Number: 09/985,693  
Art Unit: 2822

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